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(21) International Application Number: PCT/SE90/00014 (22) International Filing Date: 10 January 1990 (10.01.90) (30) Priority data: 8900052-5 10 January 1989 (10.01.89) SE (71) Applicant (for all designated States except US): POLY-WOOD PATENT AB [SE/SE]; Box 167, S-313 00 Ökarström (SE). (72) Inventors; and (75) Inventors/Applicants (for US only): WUORELA, Raimo [SE/SE]; c/o Ingrid Olsson, Västgötagatan 4, S-262 00 Ängelholm (SE). JANSSON, Jan, Erik [SE/SE]; Skolvägen 19, S-197 19 Bro (SE). (74) Agent: AWAPATENT AB; Box 5117, S-200 71 Malmö (SE).	(81) Designated States: AT, AT (European patent), AU, BB, B (European patent), BF (OAPI patent), BG, BJ (OAPI patent), BR, CA, CF (OAPI patent), CG (OAPI patent), CH, CH (European patent), CM (OAPI patent), DI, DE (European patent), DK, DK (European patent), E, ES (European patent), FI, FR (European patent), G, (OAPI patent), GB, GB (European patent), HU, IT (European patent), JP, KP, KR, LK, LU, LU (European patent), MC, MG, ML (OAPI patent), MR (OAPI patent), MW, NL, NL (European patent), NO, RO, SD, SE, S, (European patent), SN (OAPI patent), SU, TD (OAPI patent), TG (OAPI patent), US.	
Published With international search report. In English translation (filed in Swedish).		
(54) Title: PROCESS OF PRODUCING A WOOD-PLASTIC AGGLOMERATE AND USE THEREOF		
(57) Abstract A process of producing an agglomerate of wood waste and plastic in which the plastic is decomposed into smaller fractions or is supplied in decomposed state, whereupon the decomposed plastic is comminuted and molten under the action of frictional heat, moist wood waste is added, the mixture is agglomerated, and the resulting agglomerate is recovered.		

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PROCESS OF PRODUCING A WOOD-PLASTIC AGGLOMERATE
AND USE THEREOF

5 Field of the invention

The present invention relates to a process of producing an agglomerate of wood waste and plastic, as well as a use of this agglomerate for injection moulding or extrusion of products.

10 Prior art

It is known to injection mould plastic components, and it has also been tried to admix, for example, sawdust or other wood waste to the plastic, above all in order to reduce the production costs.

15 GB-1,443,194 discloses a method for producing a product of wood waste and plastic, the wood waste and the plastic being intermixed simultaneously with the actual injection moulding. The plastic and the wood waste are dosed directly into the injection moulding machine, and the wood waste is dried in connection therewith, so
20 as not to form lumps and thus give an inhomogeneous product.

DE-2,305,150 also discloses a method for producing a product of wood waste and plastic, a mixture of dry sawdust and plastic being injection moulded to form various
25 components. These methods have the disadvantage of requiring several dosing devices, as well as a drying device. The direct dosage also entails that the end product may become inhomogeneous.

30 Therefore, there is need for a simple and economical process of producing a homogeneous wood-plastic material.

Summary of the invention

35 The object of the present invention is to provide a process of producing an agglomerate of wood waste and plastic, resulting in an extremely homogeneous end product.

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Another object of the invention is to provide a process of producing an agglomerate which, in a simple and convenient manner, can be further worked, e.g. by injection moulding, into various products.

5 The process according to the invention is characterised in

that the plastic is decomposed into smaller fractions, or is supplied in a decomposed state,

10 that the decomposed plastic is comminuted while being subjected to frictional heat,

that moist wood waste is added during said comminution, so that a mixture is formed,

that this mixture is agglomerated, and

that the agglomerate is recovered.

15 The agglomerate according to the invention is intended to be used in injection moulding, extrusion or other types of moulding, for the production of various products.

20 The invention thus provides a process of producing an agglomerate of wood waste and plastic, which may then be used as such for injection moulding or the like of various end products. According to the invention, the moisture in the wood waste is used to bring about an agglomeration, and by admixing the wood waste during the actual agglomeration a very homogeneous product is obtained.

25 Furthermore, the resulting agglomerate renders the injection moulding simpler and more economical than before.

Detailed description of the invention

30 In the process according to the invention, an agglomerating device is used which chiefly comprises an upright cylindrical container with knives rotating at high speed at the bottom and, optionally, further knives fixedly mounted on the cylinder walls. The agglomerating device is
35 fed at the top and emptied at the bottom. Agglomerating devices are, for example, available from REG-MAC s.r.l., Legnano, Italy.

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The plastic film is manually fed into the cylindrical container where it is cut into strips by the rapidly rotating knives, at the same time as it is thrown towards the periphery of the container. The rotation of the knives
5 and also of the plastic particles generates frictional heat, and when the material has been reduced to a certain size, the temperature increases to a level at which the material begins to melt.

At this stage, the moist wood waste is added. Due to
10 the water in the wood waste, the melting process is interrupted, such that the heated plastic is cooled and contracts into so-called agglomerates, i.e. the wood waste and the plastic agglomerate. The cooling and the continued rotation of the knives cause the water in the wood waste
15 to evaporate in the form of water vapour. Thus, the wood waste is dried and thoroughly mixed with the plastic. Most of the wood waste is enclosed in the agglomerate particles, resulting in a very homogeneous and shelf-stable product.

20 The degree of melting of the plastic can be checked visually through the feed opening at the top of the container. The time required for the process depends on the amount of moisture to be evaporated from the wood waste, and this amount of moisture is a function of, inter alia,
25 the size of the whole charge, the mixing ratios of sawdust and plastic, and the moisture content of the sawdust. The size and appearance of the agglomerate depends, inter alia, on the temperature of the plastic when the moist wood waste is added, and on the types of plastic and additives that are used.
30

The consistency and the dry content of the mixture can also be checked visually. When the air in the container is deemed to be sufficiently dry, suitably when all visible vapour has departed, the container is emptied of
35 the mixture which, by centrifugal action, is thrown out through the discharge opening of the agglomerating device to a receptacle from which it is conducted to a storage

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silo. Then, the agglomerate is ready for use in injection moulding or other types of moulding of sundry products. Naturally, the agglomerate may also be conducted directly to an injection moulding machine or the like.

5 The wood waste employed may be sawdust, wood flour, wooden chips, shavings, or a mixture thereof, and it should have a particle size of 0.02-10 mm, preferably 2-3 mm. A suitable wood waste is sawdust, for example from a saw mill or other wood-working industry.

10 At the time of agglomeration, the wood waste should have a moisture content of 5-45% by weight, suitably 10-40% by weight, and most preferably 15-25% by weight. The plastic employed is preferably a thermoplastic, such as HD, LD, MD polyethylene, polypropylene, or polyvinyl
15 chloride plastic, or mixtures thereof. A preferred thermoplastic is polyethylene.

The agglomerate according to the invention may contain 5-90% by weight plastic and 95-10% by weight wood waste, suitably 40-60% by weight plastic and 60-40% by
20 weight wood waste.

Advantageously, the plastic employed may consist of waste raw material of mixed quality and varying purity; a product which today often is destroyed or dumped.

Conventional plastic additives, such as plasticisers,
25 may be added to or form part of the raw material employed.

The agglomerate may be used for producing injection moulded and extruded products, such as mouldings in the furniture and wood-working industries, and for manufacturing bobbins/sleeves.

30 The agglomerate according to the invention can be used as such or worked into a granulate.

Products formed from the agglomerate as such, or from a granulate produced thereof, may replace, within the furniture and wood-working industries, parts of wood or particle board components, and in doing so reduce the problem
35 of gases emanating from phenolic resin glue etc. The

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springiness and flexibility of these products also provide substantial advantages for the designer.

Since such a product is moisture-resistant, it can be used for manufacturing bobbins, sleeves and, for example, window frames, which is very advantageous as to storage possibilities and weatherproofness.

A product formed of the agglomerate according to the invention may be lacquered, glued and coloured throughout, and it may also be worked in known wood-working machines.

The product is formable after heating and dimensionally stable after cooling.

The process according to the invention is illustrated by the following nonrestrictive Examples.

Example 1

50 kg LD polyethylene film (suitable for recycling) is charged into an agglomerating device of the type designated REG-MAC 4307 manufactured by REG-MAX s.r.l., Legnano, Italy. The polyethylene film is ground for about 4 min. in the agglomerating device and has, at that time, a temperature of about 125°C. Then, 50 kg 3-millimetre sawdust having a moisture content of 20% is added. The mixture is agglomerated for 2-3 min. until no visible vapour departs from the agglomerating device. Then, the resulting agglomerate is discharged at an end temperature of 80°C.

Example 2

50 kg polypropylene is charged into an agglomerating device identical with the one in Example 1, and is ground for 5 min. At this point, the propylene plastic has a temperature of about 130°C. Then, 60 kg wood flour (25 mesh) with a moisture content of 20% is added, and this mixture is agglomerated for 3 min. Then, the resulting agglomerate is discharged at an end temperature of 80°C.

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CLAIMS

1. A process of producing an agglomerate of wood
5 waste and plastic characterised in
that the plastic is decomposed into smaller frac-
tions, or is supplied in a decomposed state,
that the decomposed plastic is comminuted while being
subjected to frictional heat,
10 that moist wood waste is added during said comminu-
tion so that a mixture is formed,
that this mixture is agglomerated, and
that the agglomerate is recovered.
2. Process as claimed in claim 1, character-
15 terised in that the added wood waste has a moisture
content of 5-45% by weight, suitably 10-40% by weight, and
especially 15-25% by weight.
3. Process as claimed in claim 1 or 2, character-
terised in that the added wood waste has a particle
20 size of 0.02-10 mm, preferably 2-3 mm.
4. Process as claimed in claim 3, character-
terised in that the added wood waste is sawdust,
wood flour, wooden chips, shavings, or mixtures thereof.
5. Process as claimed in any one of claims 1-4,
25 characterised in that the plastic employed
is a thermoplastic, such as LD, HD, or MD polyethylene,
polypropylene, polyvinyl chloride plastic, or mixtures
thereof.
6. Process as claimed in any one of claims 1-5,
30 characterised in that the added wood waste
amounts to 10-95% by weight of the total mixture, the ba-
lance being plastic.
7. Process as claimed in claim 6, character-
terised in that the added wood waste amounts to
35 40-60% by weight of the total mixture.

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8. Process is claimed in any one of claims 1-7, characterised in that the plastic employed is polyethylene, and the wood waste employed is sawdust.

9. Use of an agglomerate of wood waste and plastic, to mould a product by injection moulding, extrusion, or the like.

10. Use of an agglomerate of wood waste and plastic, to mould a granulate which, by injection moulding, extrusion, or the like, is further worked into a product.

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INTERNATIONAL SEARCH REPORT

International Application No. PCT/SE 90/00014

I. CLASSIFICATION OF SUBJECT MATTER (In several classification symbols, indicate all) ^a			
According to International Patent Classification (IPC) to both National Classification and IPC			
IPC5: B 27 N 1/02			
II. FIELDS SEARCHED			
Minimum Documentation Searcher			
Classification System			
Classification by class			
IPC5 B 27 N; B 29 J			
Documentation searched other than Minimum Documentation: to the extent that documents are included in the fields searched ^a			
SE, DK, FI, NO classes as above			
III. DOCUMENTS CONSIDERED TO BE RELEVANT^a			
Category ^a	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³	
X	GB, A, 984170 (CONWAY DOUGLAS LIMITED) 24 February 1965; see the whole document	1	
A	---	2-10	
X	Patent Abstracts of Japan, Vol 9, No 152, 1391, abstract of JP 60- 30304 publ 1985-02-15 (KOBUNSHI GIKEN K.K.)	1, 4, 5	
A	US, A, 3671615 (HERBERT S. PRICE) 20 June 1972, see the whole document	1, 5	
<p>^a Special categories of cited documents: ¹⁴</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</p> <p>"Z" document member of the same patent family</p>			
IV. CERTIFICATION			
Date of the Actual Completion of the International Search		Date of Mailing of this International Search Report	
23rd March 1990		1990-03-30	
International Searching Authority		Signature of the International Searching Authority	
SWEDISH PATENT OFFICE		Olov Jensen	

**ANNEX TO THE INTERNATIONAL SEARCH REPORT
ON INTERNATIONAL PATENT APPLICATION NO. PCT/SE 90/00014**

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.

Patent document cited in search report	Publication date	Patent family members	Publication date
GB-A- 984170	65-02-24	NONE	
US-A- 3671615	72-05-20	NONE	

